

“SUPERMALE” CADDISFLIES (TRICHOPTERA: HYDROPSYCHIDAE, PHILOPOTAMIDAE) FROM THE NORTH CENTRAL UNITED STATES¹

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ABSTRACT: Specimens of *Chimarra socia* and *Cheumatopsyche campyla* from Minnesota and Ohio, respectively, are reported with the unusual condition of possessing two sets of male genitalia. These specimens, the first report of “supermale” caddisflies from the United States are described and illustrated herein. The cause of the supermale condition remains unclear.

KEY WORDS: Trichoptera, Hydropsychidae, Philopotamidae, north central U.S.A., “supermale”

The term “übermännchen” or, in English, “supermale” or “metamale” describes sterile males with an extra male sex chromosome and often with exaggerated primary sexual characteristics (Klima and Mey 1987, Rédei 1998). Such specimens are quite rare in nature and it is not clear what causes the condition (Rédei 1998). The only known description of a possible supermale caddisfly was by Klima and Mey (1987), who discovered a specimen of the German caddisfly *Chaeopterygopsis machlachlani* Stein (Limnephilidae) with two phalli lying parallel to each other in the genital capsule and separated by a single intermediate appendage. The remainder of the genitalic structures of this specimen appeared to be normal. They hypothesized that this specimen was a supermale, although they did not provide any genetic information on it.

Other genitalic anomalies, such as intersexual and gynandromorphic individuals, have been reported in 14 caddisfly species within five families, mostly in the European literature (Nielsen 1948, Schmid 1956, Schmid 1958, McLachlan 1968, Swegman 1978, Dia and Botosaneanu 1982, Mey 1982, Klima and Mey 1987, Botosaneanu 1995). Klima and Mey (1987) provided a review of all such anomalous individuals prior to 1987.

This paper describes the apparent supermale condition in two caddisflies: a Minnesota specimen of *Chimarra socia* Hagen (Philopotamidae), and an Ohio specimen of *Cheumatopsyche campyla* Ross (Hydropsychidae). Both species are common throughout the eastern United States (Lago and Harris 1987, Nimmo 1987, Armitage 1991). In Minnesota, *C. socia* is common in the northeastern third of the state where it has been found in a variety of stream types (Houghton 2004). *Cheumatopsyche campyla* is abundant throughout Ohio and, likewise, found in a variety of habitats (B. J. Armitage, Ohio Biological Survey, personal communication). Examined material is deposited in either the University of Minnesota Insect Collection, Saint Paul, Minnesota (UMSP) or the University of Tennessee Trichoptera Collection (UT).

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Cheumatopsyche campyla, supermale

Description: Size, color, and general appearance typical of species; forewing length 9 mm; all 10 abdominal segments including genitalia present. *Genitalia* (Figure 1): Segment IX annular, broad ventrally with knob-like dorsal apex bearing long stout setae. Segment X slightly longer than deep in lateral view, extending shelf-like over inferior appendages; with median lobe bearing setae and with setaceous apical lobes knob-like in lateral view and tapering dorsally to rounded points in caudal view. With two sets of inferior appendages. One set appearing normal, each appendage with basal segment elongate in lateral view, bearing fine setae basally and stout setae apically; apical segment broader basally, tapering to sinuate apex. Second set of inferior appendages attached inward of normal set and asymmetrical in placement; right abnormal appendage rotated approximately 165° outwardly, left abnormal appendage rotated approximately 120° outwardly, both abnormal appendages offset approximately 10° clockwise, abnormal appendages otherwise similar to normal appendages. With two phalli, each rotated approximately 90° outwardly, parallel to each other and with their dorsal (now lateral) surfaces attached medially; phallic complex offset approximately 15° clockwise in genital capsule; both phalli typical in appearance with slightly enlarged ovate apices and complete phallobases; neither phallus appearing attached to ejaculatory duct.

Material Examined: OHIO: Montgomery Co., Wright-Patterson Air Force Base, 2.5 km wsw of Fairborn, 27.vii.1999, u.v. light, 1 supermale ♂ (UT); MINNESOTA: Koochiching Co., Rainy R., confl. Little Fork R., S.H. 11, 12.vii.1999, D.C. Houghton, u.v. light, 3 normal ♂♂; Anoka Co., Coon Cr., Coon Rapids Regional Park, 14.vii.2000, D.C. Houghton, u.v. light, 7 normal ♂♂; Crow Wing Co., Pine R., S.R. 169, 20.vii.2000, D.C. Houghton, u.v. light, 23 normal ♂♂ (UMSP).

Chimarra socia, supermale

Description: Size, color, and general appearance typical of species; forewing length 6 mm; all 10 abdominal segments including genitalia present. *Genitalia* (Figure 2): Segment IX annular, with elongate spatulate mesal lobe on venter of sternum. Tergum X membranous, extended shelf-like caudally. Intermediate appendages sclerotized; curved and spatulate in dorsal view, each with two stout setae at apex. Preanal appendages lobe-like and setose, attached to intermediate appendages basally. With two sets of inferior appendages. One set appearing normal; each appendage with quadrate mesal lobe on inner surface near base bearing few setae; in lateral view base setose, projecting ventrad; remainder of appendage elongate with scattered setae; apical region broad, bearing setae. Second set of inferior appendages slightly thinner than and protruding caudad of normal set; attached inward of normal set and rotated approximately 45° inwardly; otherwise similar to normal set with similar setal arrangement. With two phalli, in dorsal view oriented parallel to each other in approximately the usual position within the genital capsule. Right phallus attached to ejaculatory duct and appearing normal, sclerotized laterally for majority of length with trilobed membranous apical portion; containing two pairs of internal sclerotized rods; outer pair slender, elongate, tips protruding apically from membranous region of phallus; inner pair sinuate, less heavily sclerotized. Left phallus without ejaculatory duct or complete phallobase; similar in appearance to right phallus with membranous apical lobes of phallus more distinct and with sinuate inner sclerotized rods protruding apically from phallic membrane.

Material Examined: MINNESOTA: Koochiching Co., Rainy R., confl. Little Fork R., S.H. 11, N 48° 31.174', W 93° 34.174', 244 m, 12.vii.1999, D.C. Houghton, u.v. light, 1 supermale ♂ (UMSP); same, 13 normal ♂♂; Lake Co., Baptism R., S.R. 1, Eckbeck Cpgrd, 30.vii.1991, R.J. Blahnik, u.v. light, 5 normal ♂♂ (UMSP).

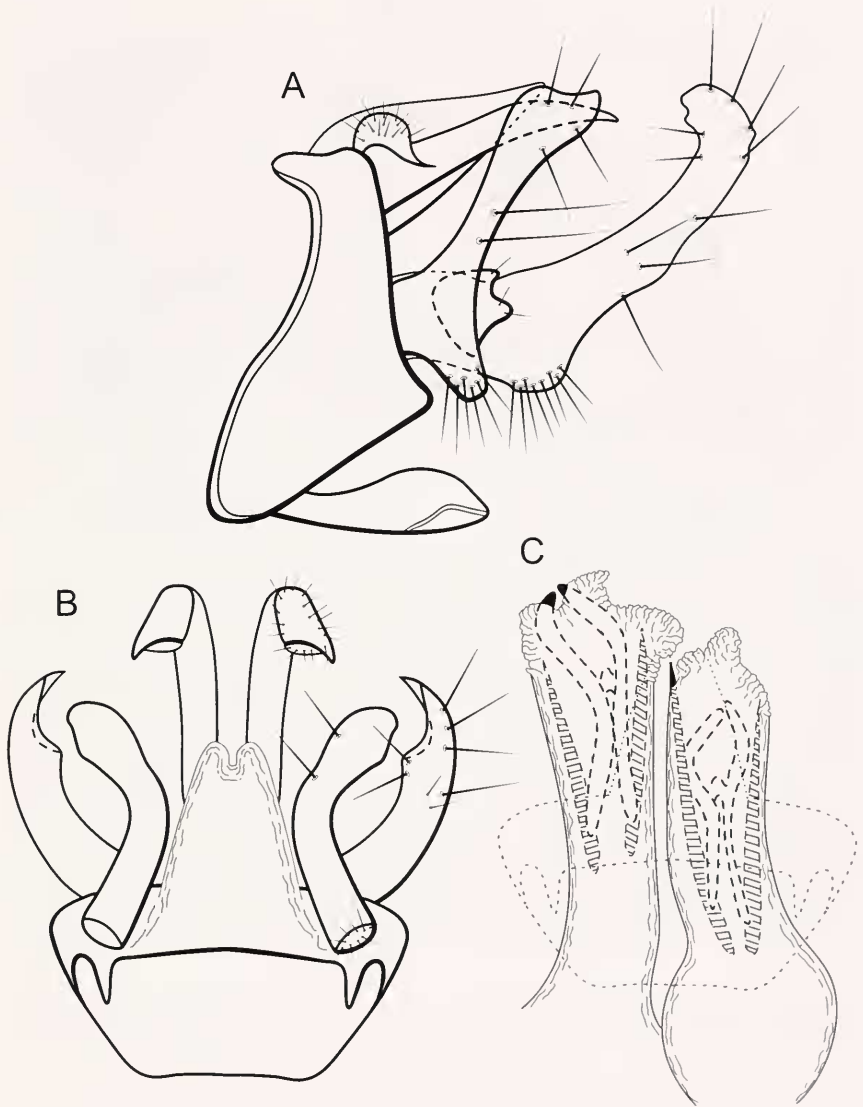


Figure 1. *Cheumatopsyche campyla*, supermale, male genitalia. A: Segments IX, X, inferior appendages, lateral. B: Segments IX, X, dorsal. C: Segments IX, X, Phalluses, dorsal. D: Tergum X, caudal.

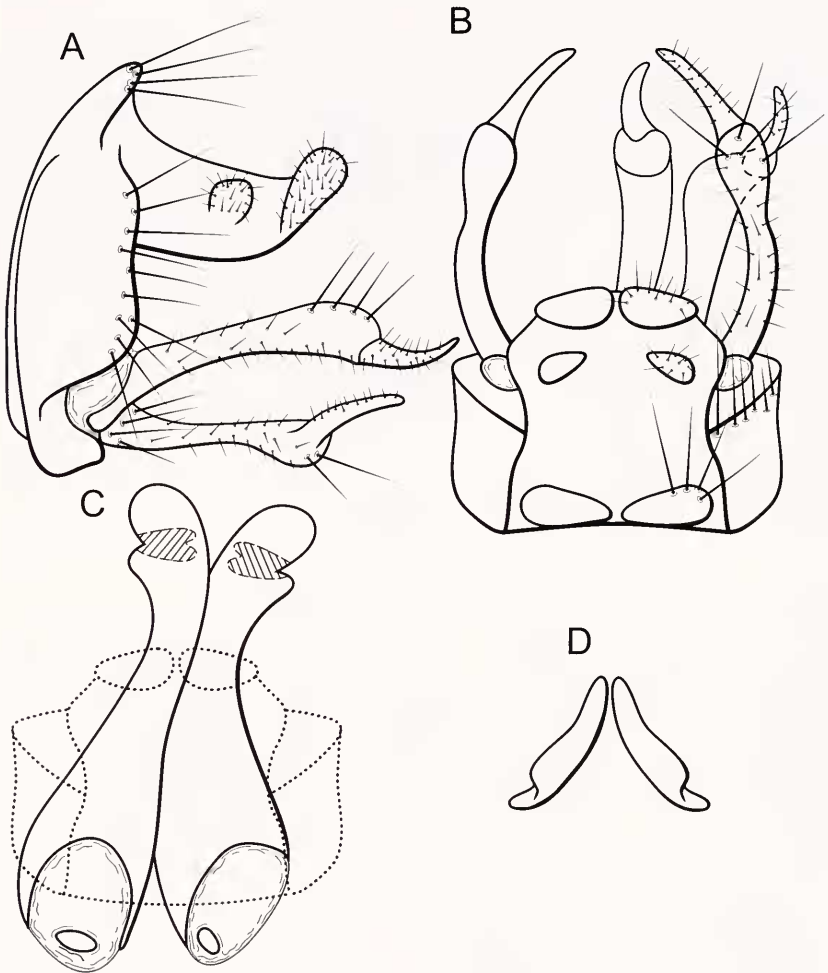


Figure 2. *Chimarra socia*, supermale, male genitalia. A: Segments VIII, IX, X, inferior appendages, lateral. B: Segments IX, X, dorsal. C: Segments IX, X, Phalluses, dorsal.

DISCUSSION

Except for the obvious anomalies, the general appearance and genitalia of these supermale specimens are similar to past descriptions of *C. socia* (e.g., Hagen 1861, Banks 1911, Ross 1944, Lago and Harris 1987) and *C. campyla* (e.g., Ross 1938, Nimmo 1987, Moulton and Stewart 1996), respectively. Likewise, they appear similar to other males examined from various locations in Minnesota. The chromosomal condition of both specimens is unknown.

The cause of genitalic anomaly remains a matter of conjecture. Under experimental conditions using x-rays, Patterson (1931) induced only a 0.03 percent occurrence of gynandromorphs in a colony of *Drosophila melanogaster*. Klima and Mey's (1987) supermale of *Chaopterygopsis machlachlani* was collected along with an intersex specimen and 173 normal individuals. The authors speculated that this high prevalence of genitalic anomaly occurred due to chromosomal interaction caused by inbreeding in the species' isolated spring habitat rather than from mutation. Due to the widespread distribution of *C. campyla* and *C. socia* (Lago and Harris 1987, Nimmo 1987, Armitage 1991, Houghton 2004), it seems unlikely that inbreeding could be the cause of their supermale condition.

Although anthropogenic pollution has been shown to cause morphological aberrations in both vertebrates and invertebrates (Dickman et al. 1992, Maden et al. 1993, Fort et al. 1999, Gardiner and Hoppe 1999), more information about the collecting localities must be obtained before such a hypothesis could be made about the supermale specimens described here. The *C. socia* specimen was collected from the confluence of two large (>100 m wide) rivers, the Rainy and the Little Fork, shortly after dusk. This site is located on the Canadian border and approximately 20 km downstream of International Falls, a town of 6,700 (IFCC 2000). This same collection contained 47 species of caddisflies and 13 male specimens of *C. socia* without genitalic anomaly. The *C. campyla* specimen was collected from Wright-Patterson Air Force Base in southwestern Ohio. The same collection yielded 23 species of caddisflies and 123 male specimens of *C. campyla* without abnormality. It will be difficult to determine the cause of the supermale condition with such a small number of known specimens.

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